



GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

IoT TECHNICIAN (SMART AGRICULTURE) **(INTERNET OF THINGS)**

(Duration: One year)

CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL- 4



SECTOR –IT & ITES

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IoT TECHNICIAN (SMART AGRICULTURE)

(INTERNET OF THINGS)

(Non-Engineering Trade)

(Designed in 2018)
Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

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Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

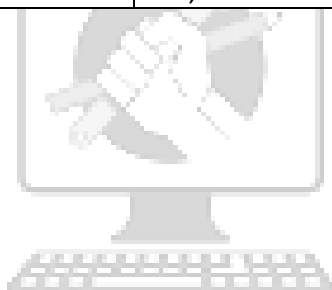
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S No.	Topics	Page No.
1.	Course Information	1
2.	Training System	2-5
3.	Job Role	6
4.	General Information	7-8
5.	NSQF Level Compliance	9
6.	Learning/ Assessable Outcome	10-11
7.	Learning Outcome with Assessment Criteria	12-20
8.	Syllabus - Professional Skill, Professional Knowledge	21-44
9.	Syllabus – Core Skills (Employability Skill)	45-48
10.	Annexure - I	
	List of Trade Tools & Equipment	49-63
	List of Tools & Equipment for Employability Skill	64
11.	Annexure II - Format for Internal Assessment	65

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1. COURSE INFORMATION

During the one-year duration of IoT Technician (Smart Agriculture) trade a candidate is trained on professional skill, professional knowledge and Employability skill. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered related to the trade are categorized in two semester of six months duration each. The semester wise course coverage is categorized as below:-

1st Semester - In the first semester, the trainee will select and perform electrical/ electronic measurement of meters and instruments. They will test various electronic components using proper measuring instruments and compare the data using standard parameter. The trainees will be able to Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup. They will construct, test and verify the input/ output characteristics of various analog circuits. They will also assemble simple electronic power supply circuit and test for functioning and test and troubleshoot various digital circuits. They will install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. They will develop troubleshooting skills in various standard electronic circuits using electronic simulation software. Trainees will apply the principle of sensors and transducers for various IoT applications. They can explore the need of different signal conditioning and converter circuits. They will also identify, test and troubleshoot the various families of Microcontroller. Trainees will plan and interface input and output devices to evaluate performance with Microcontroller. The trainee will identify different IoT Applications with IoT architecture.

2nd Semester – In the second semester the trainees will identify different IoT applications with IoT architecture. They will also identify and select various types of sensors used in Smart Agriculture. Trainees will position the appropriate sensors and collect the information required in Smart Agriculture. They will identify and select different wireless communication modules and topology to generate and record the data. They will get knowledge of Solar Panel Basics Testing, Characteristics, Charge Controller Circuit. They can perform installation, configuration and working of IOT devices, network, database, app and web services. They will identify and install the devices used in green house. They will monitor soil moisture, temperature etc. for controlling irrigation & record data. They can select plant health monitoring system and apply proper water, fertilizer and pesticides. They will also Identify and install the appropriate device for livestock monitoring and Identify, select, install and troubleshoot the components of drones. They will be able to collect data using drones.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of the economy/ labour market. The vocational training programs are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programs of NCVT for propagating vocational training.

IoT Technician (Smart Agriculture) Trade under CTS is one of the newly designed courses. CTS courses are delivered nationwide through network of ITIs. The course is of one year (02 semester) duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Trainee needs to demonstrate broadly that they are able to:

- Read and interpret technical parameters/ documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge & employability skills while performing the job and repair & maintenance work.
- Document the technical parameter related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can join as a technician in different IoT application industries for repair, servicing and installation of IoT devices.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year (02 semesters): -

Sl. No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1350
2	Professional Knowledge (Trade Theory)	270
3	Employability Skills	110
4	Library & Extracurricular activities	70
5	Project work	120
6	Revision & Examination	160
	Total	2080

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first two semesters itself.

a) The **Internal Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 50% weightage is applied to the result of each semester examination.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while

undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.

(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.



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3. JOB ROLE

Brief description of job role:

IoT Technician (Smart Agriculture); tests electronic components and circuits to locate defects, using instruments such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and performs basic/SMD soldering/desoldering. Assembles, tests and troubleshoot various digital circuits. Constructs & tests electronic power supply circuit for proper functioning. Install, configure and interconnect different computer systems & networking for different applications. Develop various standard electronic circuits using electronic simulator software's. Applies the principle of sensors & transducers for various IoT applications. Plans & interfaces input & output devices to evaluate performance with microcontrollers.

The individual in this job identifies different IOT enabled system/application in agricultural field such as **Precision Farming, Livestock Monitoring, Agricultural Drones** etc. for farmers to maximize yields using minimal resources such as water, fertilizer and seeds. Selects **various types of sensors** as per requirement for Smart Agriculture. Positions appropriate sensors and collects necessary data like various types of soil properties including compaction, structure, pH and nutrient levels etc., soil temperature at various depths, rainfall etc. at predetermined intervals. Identifies and selects different **wireless communication** modules and topology such as Zigbee, Bluetooth, GSM module, WiFi, Ethernet, M2M Wireless Sensor Network (WSN) etc. Uses signals from GPS, Geographical information system (GIS) for more detailed analysis of fields. Identifies and install the appropriate devices such as Location Sensors, GPS & GPS integrated circuits, Wearable sensors to cattle for **livestock monitoring** by collecting data regarding the location, well-being and health of cattle. Installs the devices used in **green house** such as Carbon dioxide, Oxygen, Air temperature sensors etc. Apply various Precision Agriculture tools like Soil Mapping, Yield Mapping, Remote Sensing, Variable Rate Technology, Integrated Pest & Weed Management, Water Management etc. for precision irrigation. Applies knowledge of **Solar Panel** Basics Testing, Characteristics, Charge Controller Circuit etc. Selects **plant health monitoring system** and measures leaf health, lighting brightness, chlorophyll amount, ripeness level, Leaf Area Index (LAI) etc. for crop mapping, disease/pest location alerts, solar radiation predictions and right amount of fertilizing etc. Installs and troubleshoots the components of **drones/UAV** equipped with appropriate cameras, sensors (Optical Sensors etc.) and integrating modules (Raspberry Pi 3 B module) for crop monitoring & spraying, soil & field analysis, plant counting and yield prediction, plant height measurement, canopy cover mapping and so on.

Reference NCO-2015: NIL (To be prepared)

4. GENERAL INFORMATION

Name of the Trade	IoT TECHNICIAN (SMART AGRICULTURE)
NCO - 2015	Not Available
NSQF Level	Level 4
Duration of Craftsmen Training	One Year (2 Semesters)
Entry Qualification	Passed 10 th class examination under 10+2 system of education with Science and Mathematics
Unit Strength (No. Of Student)	20 (Max. supernumeraries seats: 6)
Space Norms	70 Sq. m
Power Norms	3.45 KW
Instructors Qualification for	
1. IoT Technician (Smart Agriculture) Trade	Degree in Electronics / Electronics and Telecommunication/ Electronics and communication Engineering / Electronics & Instrumentation from recognized Engineering College/ university with one year experience in the relevant field. OR Diploma in Electronics / Electronics and telecommunication/ Electronics and communication/ Electronics & Instrumentation from recognized board of technical education with two years experience in the relevant field. OR NTC/NAC passed in the Trade With 3 years' post qualification experience in the relevant field. Desirable: - Preference will be given to a candidate with CIC (Craft Instructor Certificate) in the trade. <i>Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i>
2. Employability Skill	MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes. AND Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. OR Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes.

List of Tools & Equipment	As per Annexure-I			
Distribution of training on Hourly basis: (Indicative only)				
Total Hrs /week	Trade Practical	Trade Theory	Employability Skills	Extra-Curricular Activity
40 Hours	30 Hours	6 Hours	2 Hours	2 Hours



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5. NSQF LEVEL COMPLIANCE

NSQF level for **IoT Technician (Smart Agriculture)** trade under CTS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. professional knowledge
- c. professional skill
- d. core skill
- e. Responsibility

The Broad Learning outcome of **IoT Technician (Smart Agriculture)** trade under CTS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

6. LEARNING/ ASSESSABLE OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

6.1 GENERIC LEARNING OUTCOME

1. Apply safe working practices.
2. Comply with environment regulation and housekeeping.
3. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
4. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
5. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
6. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.

6.2 SPECIFIC LEARNING OUTCOME

SEMESTER-I

7. Select and perform electrical/ electronic measurement of meters and instruments.
8. Test various electronic components using proper measuring instruments and compare the data using standard parameter.
9. Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.
10. Construct, test and verify the input/ output characteristics of various analog circuits.
11. Assemble, test and troubleshoot various digital circuits.
12. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.
13. Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software.
14. Apply the principle of sensors and transducers for various IoT applications.
15. Identify, select and test different signal conditioning and converter circuits. Check the specifications, connections, configuration and measurement of various types of sensor inputs as well as control outputs.
16. Identify, Test and troubleshoot the various families of Microcontroller.
17. Plan and Interface input and output devices to evaluate performance with Microcontroller.

18. Identify different IoT Applications with IoT architecture.
19. Identify, test and interconnect components/parts of IoT system.

SEMESTER-II

20. Identify and select various types of sensors used in Smart Agriculture.
21. Position the appropriate sensors and collect the information required in Smart Agriculture.
22. Identify, select different wireless communication modules and topology to generate and record the data.
23. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol
24. Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit.
25. Perform installation, configuration and Check working of IOT devices, network, database, app and web services.
26. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring.
27. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.
28. Identify and install the devices used in green house.
29. Monitor soil moisture, temperature etc. for controlling irrigation & record data.
30. Select plant health monitoring system and apply proper water, fertilizer and pesticides.
31. Identify and install the appropriate device for livestock monitoring.
32. * Identify, select and operate drone in various applications.
33. *Collect data using Drones.

Note: * Can be achieved with the help of industry

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING / ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
1. Apply safe working practices.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
2. Comply with environmental regulation and housekeeping.	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	2.2 Deploy environmental protection legislation & regulations
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner
	2.4 Avoid waste and dispose waste as per procedure
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Work in a team, understand and practice soft skills, technical English to	3.1 Obtain sources of information and recognize information.
	3.2 Use and draw up technical drawings and documents.
	3.3 Use documents and technical regulations and occupationally related provisions.

communicate with required clarity.	3.4	Conduct appropriate and target oriented discussions with higher authority and within the team.
	3.5	Present facts and circumstances, possible solutions & use English special terminology.
	3.6	Resolve disputes within the team
	3.7	Conduct written communication.
4. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	4.1	Explain the concept of productivity and quality tools and apply during execution of job.
	4.2	Explain basic concept of labour welfare legislation, adhere to responsibilities and remain sensitive towards such laws.
	4.3	Knows benefits guaranteed under various acts.
5. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	5.1	Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.
	5.2	Explain standard procedure for disposal of waste.
6. Explain entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	9.1	Explain entrepreneurship.
	9.2	Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies/ programmes, procedure & the available scheme.
	9.3	Prepare a report to become an entrepreneur for submission to financial institutions.

SPECIFIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING / ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
SEMESTER-I	
7. Select and perform electrical/ electronic measurement of meters and instruments.	7.1 Plan work in compliance with standard safety norms.
	7.2 Identify the type of electronic instruments.
	7.3 Measure the value of resistance, voltage and current using digital multimeter.
8. Test various electronic components using proper measuring instruments and compare the data using standard parameter.	8.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	8.2 Plan work in compliance with standard safety norms.
	8.3 Identify the different types of resistors.
	8.4 Measure the resistor values using colour code and verify the reading by measuring in multi meter.
	8.5 Identify the power rating using size.
	8.6 Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.
	8.7 Identify different inductors and measure the values using LCR meter.
	8.8 Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
9. Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.	9.1 Identify the various crimping tools for various IC packages.
	9.2 Identify different types of soldering guns and choose the suitable tip for the application.
	9.3 Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.
	9.4 Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms.
	9.5 Identify SMD components, de-solder and solder the SMD components on the PCB.
	9.6 Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects.
	9.7 Avoid waste, ascertain unused materials and components for safe disposal.
10. Construct, test and verify the input/ output characteristics of various analog circuits.	10.1 Ascertain and select tools and instruments for carrying out the jobs.
	10.2 Plan and work in compliance with standard safety norms.
	10.3 Practice on soldering components on lug board with safety.
	10.4 Identify the passive /active components by visual appearance,

	Code number and test for their condition.
	10.5 Construct and test the transistor based switching circuit
	10.6 Construct and test CE amplifier circuit
	10.7 Ascertain the performance of different oscillator circuits.
	10.8 Construct and test Clipper, Clamper circuit.
11. Assemble, test and troubleshoot various digital circuits.	11.1 Illustrate to practice the digital trainer kit with safety.
	11.2 Identify various digital ICs, test IC using digital IC tester and verify the truth table.
	11.3 Test and verify the truth table of all gates using NOR and NAND gates.
	11.4 Test a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.
	11.5 Test a multiplexer and de-multiplexer and verify the truth table.
	11.6 Construct and verify the truth table of various flip flop, counter and shift register circuits.
12. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.	12.1 Plan, work in compliance with standard safety norms.
	12.2 Select hardware and software component.
	12.3 Install and configure operating systems and applications.
	12.4 Integrate IT systems into networks.
	12.5 Deploy tools and test programmes.
	12.6 Avoid e-waste and dispose the waste as per the procedure.
13. Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software.	13.1 Identify & Select the component
	13.2 Prepare simple digital and electronic circuits using the software.
	13.3 Test the simulation circuit.
	13.4 Convert the circuit into layout diagram.
	13.5 Follow the instruction manual.
14. Apply the principle of sensors and transducers for various IoT applications.	14.1 Identify the sensor.
	14.2 Select the sensor for proper applications.
	14.3 Check the functioning of the sensor.
	14.4 Measure the voltage of LVDT.
	14.5 Measure the voltage output of Thermocouple , Resistance of RTD
	14.6 Measure the voltage output of Load Cell/Strain Gauge, Smoke
	14.7 Test Digital Output of Speed Sensor ,Limit Switch, Optocoupler, Photo and Proximity Sensor
	14.8 Follow instruction manual.
15. Identify, select and test different signal conditioning and	15.1 Explore different driving circuits used for sensors.
	15.2 Explore different converters like V/I, I/V, F/V and V/F.
	15.3 Explore low pass and high pass filter.

converter circuits. Check the specifications, connections, configuration, calibration and measurement of various type of sensor inputs as well as control outputs.	15.4	Explore analog to digital and digital to analog converter ICs like ADC0808, DAC0808.
	15.5	Connect and measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV etc signals.
	15.6	Configure Electrical zero/span – mV, 0-10VDC, 4-20mA, 0-20mA
	15.7	Configure Engineering zero/span – understanding various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc.
	15.8	Test the Analog Input as per configuration and sensor selection.
	15.9	Generate 0-10VDC and measure analog outputs to operate control valves and actuators
	15.10	Connect and measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) and verify the expected output.
	15.11	Connect and measure Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters and verify the expected output.
	15.12	Select, Configure and Connect Digital Outputs and Relay Outputs to take On and Off action for various actuators and verify the expected output.
16. Identify, Test and troubleshoot the various families of Microcontroller.	16.1	Understand and interpret the procedure as per manual of Micro controller.
	16.2	Identify various ICs & their functions on the given Microcontroller Kit.
	16.3	Identify the address range of RAM & ROM.
	16.4	Write data into RAM & observe its volatility.
	16.5	Identify the port pins of the controller & configure the ports for Input & Output operation.
	16.6	Demonstrate entering of simple programs, execute & monitor the results.
17. Plan and Interface input and output devices to evaluate performance with Microcontroller.	17.1	Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch
	17.2	Use 8051 microcontroller, connect LCD, Relay, Keypad and seven segments
	17.3	Perform the use of a ADC and DAC to read input voltage and provide output voltage
	17.4	Perform the use of RS232 and USB interface with Computer interface.
	17.5	Demonstrate entering of simple programs, execute & monitor the results.
18. Identify different IoT	18.1	Identify various IoT Applications in smart city viz. smart

Applications with IoT architecture.	environment, smart street light and smart water & waste management.
	18.2 Recognise the functions of various IoT Technician (Smart City) (IoT) applications & their distinctive advantages.
	18.3 Identify and explore different functional building blocks of IoT enabled system / application.
	18.4 Explore signal flow into IoT enabled system/application as per the IoT architecture.
19. Identify, test and interconnect components/parts of IoT system.	19.1 Connect and test Arduino board to computer and execute sample programs from the example list.
	19.2 Write and upload computer code to the physical Arduino board Micro controller to sound buzzer.
	19.3 Set up & test circuit to interface potentiometer with Arduino board and map to digital values.
	19.4 Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD.
	19.5 Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on/off/forward/reverse operations.
SEMESTER-II	
20. Identify and Select various types of sensors used in Smart Agriculture.	20.1 Identify Roles and characteristics of various sensors.
	20.2 Select appropriate sensor as per requirement.
	20.3 Use signals from GPS satellites in Location Sensors.
	20.4 Place self-contained units of Agricultural Weather Stations at various locations throughout growing fields.
	20.5 Combine sensors appropriate for the local crops and climate for Agricultural Weather Stations
	20.6 Measure pH using Electrochemical Sensors and soil nutrient levels.
	20.7 Detect specific ions in the soil by Electrochemical Sensor electrodes
	20.8 Apply Electrochemical Sensor to gather process and map soil chemical data.
	20.9 Measure soil compaction or “mechanical resistance” by Mechanical Sensors
	20.10 Use Mechanical Sensors on large tractors to predict pulling requirements for ground engaging equipment.
	20.11 Measure soil air permeability by Airflow Sensors at singular locations or dynamically while in motion
	20.12 Identify various types of soil properties including compaction, structure, soil type, and moisture level by Airflow Sensors.
21. Position the appropriate sensors	21.1 Identify sensors node block diagram and its components.
	21.2 Connect sensors and send data wirelessly to a central data

and collect the information required in Smart Agriculture.	logger at program.
	21.3 Perform interfacing of wireless modules with IoT platform.
	21.4 Select and Install sensors like CO ₂ , O ₂ , VOC, air temperature, humidity, moisture, etc.
	21.5 Identify and use sensor node configuration tool.
	21.6 Configure Sensor node using USB and Over the air programming.
	21.7 Connect solar panel with sensor node.
	21.8 Control Variable rate controllers manually
	21.9 Observe safety precaution
22. Identify, select different wireless communication modules and topology to generate and record the data.	22.1 Create Wireless sensor network with interfacing of Zigbee module.
	22.2 Identify interfacing of Bluetooth module to create local sensor network.
	22.3 Interfacing of GSM module to make node as a gateway.
	22.4 Use WiFi and Ethernet for IoT Gateway.
	22.5 Apply GPS satellites in Location Sensors.
	22.6 RS485 interface for industrial agriculture sensors.
	22.7 Create a combine sensor appropriate for the local crops.
	22.8 Use portable Agricultural Weather Stations.
	22.9 Operate Global Positioning System (GPS).
	22.10 Apply satellites broadcasting signals in IoT.
	22.11 Apply Precision irrigation through water management in precision agriculture.
23. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	23.1 Cable selection and Termination for Wired Communication Mediums : Pin Diagram, Cable Core, characteristics and specifications, Connector and crimping of various RJ9/RJ11/RJ45 connectors
	23.2 Frequency Band, Gain, Antenna and Modulation selection for wireless communication Mediums
	23.3 Basic Network Configuration of Local Area Networks - Ethernet, Wi-Fi,
	23.4 Basic Configuration of Cellular Wide Area Networks - GSM, GPRS
	23.5 Basic Configuration of Personal Area Networks - RF, Zigbee
24. Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit.	24.1 Test series combination of Solar PV Modules.
	24.2 Test parallel combination of Solar PV Modules
	24.3 Test VI Characteristics of Solar PV Module.
	24.4 Test series-parallel combination of Solar PV Modules.
	24.5 Test blocking diode and its working in Solar PV Module.
	24.6 Test bypass diode and its working in Solar PV Module

	24.7 Follow the instruction manual.
25. Perform installation, configuration and Check working of IOT devices, network, database, app and web services.	25.1 Install Linux Operating System porting. 25.2 Configure Local cloud & server. 25.3 Configure GUI based parameter. 25.4 Manage user access and security. 25.5 Test Qt based GUI.
26. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols and networking topology and device management and monitoring.	26.1 Configure and integrate multiple devices with serial protocol working on RS485 MODBUS Master –Slave architecture such as Solar Inverter, Solar Pump Controller, Energy Meter etc. 26.2 Configure and integrate multiple devices with serial protocol working on RS232 DLMS Server – Client architecture 26.3 Configure Wired and Wireless Local Area Networks (Ethernet and Wi-Fi) for MODBUS over MQTT in IoT Applications 26.4 Configure cellular IoT Connectivity using GSM/GPRS networks for MODBUS over MQTT in IoT Applications 26.5 Select, Configure and Ascertain various media converters to convert serial devices to Ethernet, Wi-Fi and GPRS Devices 26.6 Select, Configure and Ascertain various protocol converters to convert serial as well as networking devices to IoT Devices 26.7 Create / Modify and Configure IoT Devices and its parameters on cloud platform 26.8 Monitor and Diagnose IoT Devices on cloud platform 26.9 Configure parameters, alarms, notifications on cloud platform 26.10 Create / Modify organization and users to access device data with user management roles and security
27. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.	27.1 Develop and Deploy web application using ready to use API of IoT platform or architecture 27.2 Display and Configure graphs, charts and other ready to use controls and widgets 27.3 Generate reports using readily available API, templates and to export it to excel, word pdf and other required formats
28. Identify and install the devices used in green house.	28.1 Select and Installation of Carbon dioxide sensors. 28.2 Select and Install of Oxygen sensors. 28.3 Install solar pump, motors and drip irrigation systems. 28.4 Observe safety precaution. 28.5 Follow instruction manual.
29. Monitor soil moisture, temperature etc. for controlling irrigation & record data.	29.1 Carry out Crop and soil observations logged in the form of snapped pictures, pinpoint locations, soil colours, water, plant leaves, and light properties. 29.2 Measure leaf health, lighting brightness, chlorophyll amount, ripeness level, Leaf Area Index (LAI), soil organic and carbon

	makeup by using Smartphone Camera.
	29.3 Perform predictive maintenance of machinery using Microphone.
	29.4 Determine Leaf Angle Index using Accelerometer.
	29.5 Apply Precision irrigation through water management in precision agriculture.
	29.6 Apply various Precision Agriculture tools.
	29.7 Identify various benefits of application of Precision Agriculture in Smart Farming.
30. Select plant health monitoring system and apply proper water, fertilizer and pesticides.	30.1 Explore and test Non-contact surface temperature measurement.
	30.2 Test Air temperature, humidity and pressure.
	30.3 Test Conductivity, water content and soil temperature.
	30.4 Test Soil temperature and volumetric water content.
	30.5 Test Leaf wetness.
	30.6 Apply safe working practices.
31. Identify and install the appropriate device for livestock monitoring.	31.1 Apply Wireless IoT in livestock monitoring.
	31.2 Collect data regarding the location.
	31.3 Well-being and health of cattle.
	31.4 Use Location Sensors, GPS & GPS integrated circuits.
	31.5 Apply Wearable Electronics to cattle example Fly off
	31.6 Select wireless technology with enough battery power to list the lifespan of the animal.
	31.7 Follow manual.
32. Identify, select and operate drone in various applications.	32.1 Identify different types of drones.
	32.2 select drones in smart agriculture for particular operation
	32.3 Identify and Select various components of drones.
	32.4 Follow proper safety procedure as per manual
33. Collect data using Drones.	33.1 Use ground-based and aerial based drones in agriculture.
	33.2 Assess crop health, irrigation, crop monitoring, crop spraying, planting and soil & field analysis
	33.3 Use thermal camera in smart farming
	33.4 Carry out real-time data collection and processing
	33.5 Analyse Drone data for insights regarding plant health indices.
	33.6 Perform in-flight monitoring and observations.

SYLLABUS - IoT TECHNICIAN (SMART AGRICULTURE)

FIRST SEMESTER – 06 Months

Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
1	Apply safe working practices	Trade and Orientation 1. Visit to various sections of the institute and identify location of various installations. (06 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (04 hrs) 3. Use of personal protective equipment (PPE). (06 hrs) 4. Practice elementary first aid. (06 hrs) 5. Preventive measures for electrical accidents & steps to be taken in such accidents. (03 hrs) 6. Use of Fire extinguishers. (05 hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.
2-3	Select and perform electrical/ electronic measurement of meters and instruments.	Basics of AC and Electrical Cables 7. Identify the Phase, Neutral and Earth on power socket, use a testers to monitor AC power. (08 hrs) 8. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing. (10 hrs) 9. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (08 hrs) 10. Measure the gauge of the wire using SWG and outside micrometer. (05 hrs) 11. Crimp the lugs to wire end. (06 hrs) 12. Measure AC Voltage in three phase , Three phase star and	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc. Introduction to electrical and electronic measuring instruments.

		delta correction , Three phase power measurement. (08 hrs) 13. Demonstrate various test and measuring instruments (08 hrs) 14. Measure voltage and current using clamp meter. (07 hrs)	
4-5	Test various electronic components using proper measuring instruments and compare the data using standard parameter.	Active and Passive Components 15. Identify the different types of active and passive electronic components. (02 hrs) 16. Measure the resistor value by colour code, SMD Code and verify the same by measuring with multimeter. (02 hrs) 17. Identify resistors by their appearance and check physical defects. (02 hrs) 18. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (03 hrs) 19. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (03 hrs) 20. Verify laws of series and parallel circuits with voltage source in different combinations. (03 hrs) 21. Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter. (04 hrs) 22. Identify different inductors and measure the values using LCR meter. (03 hrs) 23. Identify the different capacitors and measure capacitance of various capacitors using LCR meter. (03 hrs) 24. Identify and test the circuit breaker and other protecting devices (Fuse). (03 hrs) 25. Dismantle and identify the different parts of a relay. (04 hrs) 26. Connect a timer relay in a circuit	Ohm's law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications and energy storage concept. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Properties of magnets and their materials, preparation of artificial magnets, significance of electro Magnetism, types of cores. Relays, types, construction and specifications etc. Multi meter, use of meters in different circuits. Use of DSO, Function generator, Arbitrary Waveform Generator ,LCR meter

		and test for its working. (03 hrs) 27. Test Step-up, Step-down, Isolation Transformer. (03 hrs) AC & DC measurements 28. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R). (02 hrs) 29. Identify the different controls on the Digital Storage Oscilloscope front panel and observe the function of each control. (03 hrs) 30. Measure DC voltage, AC voltage, time period, sine wave parameters using DSO. (02 hrs) 31. Identify and use different mathematical functions +, -, X, diff, intg, AND, OR of DSO on the observed signal. (03 hrs) 32. Identify and use different acquisition modes of normal, average, persistence mode. (03 hrs) 33. Understand the difference of low memory and high memory DSO and relation with real time sampling of DSO. (02 hrs) 34. Identify the different controls on the Arbitrary Waveform Generator front panel and observe the different signals to be derived from Arbitrary Waveform Generator. (05 hrs) 35. Identify the different controls on the power supply and to understand CV/CC Mode, Dual Tracking Mode. (02 hrs)	
6-7	Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.	Soldering/ De-soldering 36. Practice soldering on different electronic components, small transformer and lugs. (03 hrs) 37. Practice soldering on IC bases and PCBs. (03 hrs) 38. Practice Soldering on various SMD Components including SMD IC packages. (05 hrs)	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications.

		39. Practice de-soldering using pump and wick. (02 hrs) 40. Practice Desoldering of SMD Components using SMD Hot Air Gun. (03 hrs) 41. Join the broken PCB track and test. (03 hrs) Basic SMD (2, 3, 4 terminal components) 42. Identification of 2, 3, 4 terminal SMD components. De-solder the SMD components from the given PCB. (05 hrs) 43. Solder the SMD components in the same PCB. Check for cold continuity of PCB. (05 hrs) 44. Identification of loose /dry solder, broken tracks on printed wired assemblies. (04 hrs) SMD Soldering and De-soldering 45. Identify various connections and setup required for SMD Soldering station. (05 hrs) 46. Identify crimping tools for various IC packages. (04 hrs) 47. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper crimping tools (06 hrs) 48. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper crimping tools (06 hrs) 49. Make the necessary setting rework of defective surface mount component used soldering / de-soldering method. (06 hrs)	Different switches, their specification and usage. Introduction to SMD technology Identification of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead components. Introduction to Surface Mount Technology (SMT). Advantages, Surface Mount components and packages. Cold/ Continuity check of PCBs. Identification of loose / dry solders, broken tracks on printed wiring assemblies.
8-9	Construct, test and verify the input/ output characteristics of	50. Identify and test different types of diodes, diode modules using multi meter and determine	Semiconductor materials, components, number coding for different electronic components

	various analog circuits.	forward to reverse resistance ratio. Compare it with specifications. (07 hrs) 51. Measure the voltage and current through a diode in a circuit and verify its forward/Reverse characteristic. (08 hrs) 52. Construct and test a half wave, full wave and Bridge rectifier circuit. (06 hrs) 53. Measure ripple voltage, ripple frequency and ripple factor of rectifiers. (06 hrs) 54. Construct and test shunt clipper and clamper circuits using diodes. (06 hrs) 55. Identify and test Zener diode and construct peak clipper. (06 hrs) 56. Identify different types of transistors and test them using digital multimeter. (06 hrs) 57. Measure and plot input and output characteristics of a CE amplifier. (08 hrs) 58. Construct and test a transistor based switching circuit to control a relay. (07 hrs)	such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications. Forward current and Reverse voltage. Working principle of a Transformer, construction, Specifications and types of cores used. Step-up, Step down and isolation transformers with applications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance. Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Transistor applications as switch and CE amplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks.
10-11	Assemble, test and troubleshoot various digital circuits.	59. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them. (04 hrs) 60. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (02 hrs) 61. Use digital IC tester to test the various digital ICs (TTL and CMOS). (03 hrs) 62. Construct and Test a 2 to 4 Decoder. (02 hrs) 63. Construct and Test a 4 to 2 Encoder. (02 hrs) 64. Construct and Test a 4 to 1 Multiplexer. (02 hrs) 65. Construct and Test a 1 to 4 De	Introduction to Digital Electronics. Difference between analog and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables. Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders.

		Multiplexer. (02 hrs) 66. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (05 hrs) 67. Construct and test a four bit asynchronous binary counter (05 hrs) 68. Construct and test a four bit Synchronous binary counter. (04 hrs) 69. Construct and test synchronous Decade counter. (04 hrs) 70. Construct and test an up/down synchronous decade counter and monitor the output on LEDs. (03 hrs) 71. Identify and test common anode and common cathode seven segment LED display using multi meter. (04 hrs) 72. Test the shift register using IC 7495. (05hrs) 73. Construct and test four bit SIPO register. (05 hrs) 74. Construct and test four bit PIPO register. (04 hrs) 75. Construct and test bidirectional shift registers. (04 hrs)	Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer / De-multiplexer. Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division. Types of seven segment display. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers.
12-13	Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.	76. Identify various indicators, cables, connectors and ports on the computer cabinet. (03 hrs) 77. Demonstrate various parts of the system unit and motherboard components. (05 hrs) 78. Identify various computer peripherals and connect it to the system. (05 hrs) 79. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (05 hrs)	Basic blocks of a computer, Components of desktop and motherboard. Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer. Working principle of SMPS, its specification. Windows OS MS widows: Starting windows and its operation, file management using explorer,

		80. Replace the CMOS battery and extend a memory module. (05 hrs) 81. Test and Replace the SMPS. (05 hrs) 82. Replace the given DVD, RAM and HDD on the system. (05 hrs) 83. Boot the system from Different options and install OS in a desktop computer. (05 hrs) 84. Install antivirus software, printer, scan the system and explore the options in the antivirus software. (04 hrs) 85. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (04 hrs) 86. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (05 hrs) 87. Prepare terminations, make UTP and STP cable connectors and test. (03 hrs) 88. Connect network connectivity hardware and check for its functioning. (03 hrs) 89. Configure a wireless Wi-Fi network. (03 hrs)	Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications. Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. Computer Networking:- Network features - Network medias Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.
14	Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software.	90. Prepare simple digital and electronic circuits using the software. (06 hrs) 91. Simulate and test the prepared digital and analog circuits. (06 hrs) 92. Create fault in particular component and simulate the circuit for it's performance. (06 hrs) 93. Convert the prepared circuit into a layout diagram. (06 hrs) 94. Prepare simple, power electronic and domestic electronic circuit using simulation software. (06 hrs)	Study the library components available in the circuit simulation software. Various resources of the software.

15	Apply the principle of sensors and transducers for various IoT applications.	95. Identify and test RTDs, Temperature ICs and Thermo couples. (06 hrs) 96. Identify and test proximity switches (inductive, capacitive and photoelectric). (06 hrs) 97. Identify and test, load cells, strain gauge, LVDT, PT 100 (platinum resistance sensor). (06 hrs) 98. Detect different objectives using capacitive, Inductive and photo electric proximity sensors. (12 hours) 	Basics of passive and active transducers. Role, selection and characteristics. Sensor voltage and current formats. Thermistors / Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors.
16-18	Identify, select and test different signal conditioning and converter circuits. Check the specifications, connections, configuration and measurement of various types of sensor inputs as well as control outputs.	99. Explore different driving circuits used for sensors.(12 hrs) 100. Amplification of low power signals using current, power, instrumentation, differential, inverting, non-inverting and buffer amplifier circuits.(12 hrs) 101. Identify analog to digital and digital to analog converter ICs like ADC0808, DAC0808.(12 hrs) 102. Explore different converters like V/I, I/V, F/V and V/F.(12 hrs) 103. Explore low pass and high pass filter. (10 hrs) Integration of Analog sensors 104. Identify various Analog sensors. (02 hrs)	Working principle of different types of control circuits and their applications for sensors. Principle of operation of signal generator, distinguish between voltage and power amplifier. Working principle of different converters. Demonstrate different types of filter circuits and their applications. The specification and working of Analog sensor inputs as well as Analog control outputs. The specifications and working of Digital sensor inputs, Pulse Input as well as Digital control outputs.

		105. Identify Roles and Characteristics of each sensor. (02 hrs) 106. Select appropriate Analog sensor. (02 hrs) 107. Connect & measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV signal etc. (02 hrs) 108. Configure Engineering & Electrical zero/span configuration mV, 0-10VDC, 4-20mA, 0-20mA. (02 hrs) 109. Understand various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc. (02 hrs) 110. Measure the Analog Input as per configuration and sensor selection. (02 hrs) 111. Generate and measure Analog Output to operate control valves and actuators. (02 hrs) Integration of Digital sensors 112. Identify various Digital sensors. (02 hrs) 113. Identify Roles and Characteristics of each sensor. (02 hrs) 114. Select appropriate Digital sensor. (02 hrs) 115. Connect and Measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) signals. (04hrs) 116. Connect Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters. (02 hrs) 117. Select, Configure and ascertain of Digital Outputs and Relay Outputs to take On and Off action for actuators. (04 hrs)	
19	Identify, Test and troubleshoot the	118. Explore different microcontroller families'	Introduction Microprocessor & 8051 Microcontroller,

	various families of Microcontroller.	architecture like 8051, AVR, PIC, ARM, Raspberry pi and Arduino. (06 hrs) 119. Explore the different Software IDE used for microcontroller. (06 hrs) 120. Explore ICs & their functions on the given Microcontroller Kit. (06 hrs) 121. Identify the port pins of the controller & configure the ports for Input & Output operation. (06 hrs) 122. Explore Universal IC programmer to program burn output file on different ICs. (06 hrs)	architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications.
20	Plan and Interface input and output devices to evaluate performance with Microcontroller.	123. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. (05 hrs) 124. Perform with 8051 microcontroller assembling language program, check the reading of an input port and sending the received bytes to the output port of the microcontroller, used switches and LCD for the input and output. (05 hrs) 125. Use 8051 microcontroller, connect LCD, Relay, Keypad and seven segments. (05 hrs) 126. Use 8051 microcontroller, connect servo, DC and stepper motor. (05 hrs) 127. Perform the use of a ADC and DAC to read input voltage and provide output voltage. (05 hrs) 128. Perform the use of RS232 and USB interface with Computer interface. (03 hrs) 129. Demonstrate entering of simple programs, execute & monitor the results. (02 hrs)	Comparative study of 8051 with 8052. Introduction to PIC Architecture. Introduction to ADC and DAC, schematic diagram, features and characteristic with the applications.
21	Identify different IoT Applications with IoT	130. Identify various IoT Applications in smart city viz.	Introduction to Internet of Things applications in smart

	architecture.	smart environment, smart street light and smart water & waste management. (07 hrs) 131. Recognise the functions of various Internets of Things (Smart City) (IoT) applications & their distinctive advantages. (08 hrs) 132. Identify and explore different functional building blocks of IOT enabled system / application. (08 hrs) 133. Test signal flow into IOT enabled system/application as per the IOT architecture. (07 hrs)	city& their distinctive advantages - smart environment, smart street light and smart water & waste management. What is an IOT? What makes embedded system an IOT? Role and scope of IOT in present and future marketplace. Smart objects, Wired – Cables, hubs etc. Wireless – RFID, WiFi, Bluetooth etc. Different functional building blocks of IOT architecture.
22	Identify, test and interconnect components/parts of IoT system.	134. Connect and test Arduino board to computer and execute sample programs from the example list. (04 hrs) 135. Upload computer code to the physical board (Microcontroller) to blink a simple LED. (02 hrs) 136. Write and upload computer code to the physical Arduino board Micro controller to sound buzzer. (02 hrs) 137. Circuit and program to Interface light sensor – LDR with aarduino to switch ON/OFF LED based on light intensity. (03 hrs) 138. Set up & test circuit to interface potentiometer with Arduino board and map to digital values for eg. 0-1023. (03 hrs) 139. Interface Pushbuttons or switches, connect two points in a circuit while pressing them. This turns on the built-in LED on pin 13 in Arduino, while pressing the button. (03 hrs) 140. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using Arduino. (02 hrs)	Arduino development board, Pin diagram, Functional diagram, Hardware familiarization and operating instructions. Integrated development Environment, Running Programs on IDE, simple Programming concepts.(10 Hours)

		141. Make Circuit and upload a program to Interface of LCD display with a microcontroller to display characters. (03 hrs) 142. Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD. (02 hrs) 143. Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on /off /forward/reverse operations. (03 hrs) 144. Rig up Circuit and upload program micro-controller to switch on/off two lights using relay. (03 hrs)	
23-24	Project Work / Industrial Visit (Optional) Broad Area: - a) Full wave Voltage rectifier with indicator. b) Flashing LEDs. c) Visit to IoT Lab of different industries.		
25	Revision		
26	Examination		

Note: -

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.
4. If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.

SYLLABUS - IoT TECHNICIAN (SMART AGRICULTURE)

SECOND SEMESTER – 06 Months

Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
27-30	Identify and Select various types of sensors used in Smart Agriculture.	145. Identify various sensors used in Precision Farming viz. Location Sensors, Optical Sensors, Electrochemical Sensors, Mechanical Sensors, Airflow Sensors and Agricultural Weather Stations. (10 hrs) 146. Select appropriate sensor as per requirement. (10 hrs) 147. Determine clay, organic matter and moisture content of the soil by Optical Sensors. (10 hrs) 148. Measure pH by Electrochemical Sensor and soil nutrient. (10 hrs) 149. Apply Electrochemical Sensor to gather process and map soil chemical data. (10 hrs) 150. Measure soil compaction or “mechanical resistance” by Mechanical Sensors. (10 hrs) 151. Use of probe that penetrates the soil and records resistive forces through use of load cells or strain gauges for Mechanical Sensors. (10 hrs) 152. Use Mechanical Sensors on large tractors to predict pulling requirements for ground engaging equipment. (10 hrs) 153. Detect the force used by the roots in water absorption that are very useful for irrigation interventions by Tensiometers. (10 hrs) 154. Measure soil air permeability by Airflow Sensors at singular locations or dynamically while in motion. (10 hrs) 155. Identify various types of soil properties including compaction, structure, soil	Basics of Location Sensors – Role, selection and characteristics, advantages and disadvantages. Use of signals from GPS satellites. Optical Sensors - Basic principle, salient features, operating range selection and characteristics. Electrochemical Sensors - Role, selection and characteristics, advantages and disadvantages. Mechanical Sensors –Operation Fundamentals, selection, advantages and disadvantages. Airflow Sensors – Basic principle, salient features, operating range, advantages and disadvantages. Agricultural Weather Stations – Fundamentals of self-contained units that are placed at various locations throughout growing fields. Knowledge of Stations, combination of sensors appropriate for the local crops and climate. Advantages - portability and decreasing prices for farms of all sizes.

		type, and moisture level by Airflow Sensors. (10 hrs) 156. Measure and record Information such as air temperature, soil temperature at a various depths, rainfall, leaf wetness, chlorophyll, wind speed, dew point temperature, wind direction, relative humidity, solar radiation and atmospheric pressure at predetermined intervals by Agricultural Weather Stations.(10 hrs)	
31-32	Position the appropriate sensors and collect the information required in Smart Agriculture.	157. Study and interpret the result of sensors node block diagram and its components. (10 hrs) 158. Connection with sensors and send data wirelessly to a central data logger at program.(10 hrs) 159. Interface of wireless modules with IoT platform. (10 hrs) 160. Select and Install sensors like CO₂, O₂, VOC, air temperature, humidity, moisture, etc. (05 hrs) 161. Identify and select the data packet and sensor node configuration tool. (10 hrs) 162. Configure Sensor node using USB and Over the air programming. (05 hrs) 163. State the battery level and solar panel connects with sensor node. (05 hrs) 164. Control Variable rate controllers manually or automatically using an on-board computer guided by real GPS location. (05 hrs)	Location Sensors - Determination of latitude, longitude and altitude, Concept of GPS integrated circuits. Optical Sensors - Measurement of different frequencies of light reflectance in near-infrared, mid-infrared, and polarized light spectrums, Placement on vehicles or aerial platforms. Determination of clay, organic matter and moisture content of the soil. Electrochemical Sensors - Collection of information like pH and soil nutrient levels, detection of specific ions in the soil. Applications to gather, process, and map soil chemical data. Mechanical Sensors –Measurement of soil compaction or “mechanical resistance”, Use of probe that penetrates the soil and records resistive forces through use of load cells or strain gauges. Detection of the force used by the roots in water absorption that are very useful for irrigation interventions.

			Airflow Sensors – Measurement of soil air permeability. Measurements at singular locations or dynamically while in motion. Knowledge of desired output - the pressure required to push a predetermined amount of air into the ground at a prescribed depth. Various types of soil properties, including compaction, structure, soil type and moisture level. Agricultural Weather Stations – Measurement and record Information such as air temperature, soil temperature at a various depths, rainfall, leaf wetness, chlorophyll, wind speed, dew point temperature, wind direction, relative humidity, solar radiation, and atmospheric pressure at predetermined intervals. Compilation and sending of data wirelessly to a central data logger at programmed intervals.
33-34	Identify, select different wireless communication modules and topology to generate and record the data.	165. Identify the interfacing of Zigbee module to create wireless sensor network. (02 hrs) 166. Check the M2M Wireless Sensor Network (WSN) in IoT Zigbee router, end device and coordinator configuration. (04 hrs) 167. Identify the interfacing of Bluetooth module to create local sensor network. (03 hrs) 168. Identify the interfacing of GSM module to make node as a gateway. (03 hrs) 169. Apply IoT Gateway using WiFi and Ethernet. (04 hrs) 170. Check UART Communication, RS485 Communication, I2C Protocol device interfacing SPI Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and	Introduction to Zigbee. Block diagram of Zigbee based sensor network. Introduction to wireless personal area network system. Introduction to Zigbee networking system. Concept of interfacing of Bluetooth module to local sensor network, interfacing of GSM module to make node as a gateway. IoT Gateway using WiFi and Ethernet. Application of GPS satellites in Location Sensors. RS485 interface for industrial agriculture sensors. Creation of a combine sensor appropriate for the local crops and for agricultural climate monitoring. Concept of portable Agricultural Weather Stations. Usage of signals from GPS satellites to determine latitude, longitude

		Router interfacing. (08 hrs) 171. Identify the Wi-Fi module and lua script for data communication. (04 hrs) 172. Check USB and Ethernet connectivity for data communication. (02 hrs) 173. Check RS485 interface for industrial agriculture sensors. (02 hrs) 174. Create a combine sensor appropriate for the local crops and for agricultural climate monitoring. (04 hrs) 175. Use portable Agricultural Weather Stations. (03 hrs) 176. Use signals from GPS satellites to determine latitude, longitude and altitude to within feet by Location Sensors for precise positioning. (03 hrs) 177. Measure yield and grain moisture in a field using crop yield measuring devices installed on harvesting equipment. (02 hrs) 178. Use Geographical information system (GIS) consisting of a computer software data base system used to input, store, retrieve, analyze and display in map like form, spatially referenced geographical information for more detailed analysis of fields. (04 hrs) 179. Analyze the data collected by yield monitor and GPS and supply it to user in usable format such as maps, graphs, charts or reports using suitable Computer Hardware and Software. (04 hrs) 180. Apply Precision irrigation through water management in precision agriculture. (04 hrs) 181. Identify zones in the field that are irrigated with differing	and altitude to within feet by Location Sensors for precise positioning. Use of Yield Monitors – measurement of yield and grain moisture in a field using crop yield measuring devices installed on harvesting equipment. Principle of operation & Application of Global Positioning System (GPS): satellites broadcasting signals that allow GPS receivers to calculate their position. Working principle & Use of Geographical information system (GIS) consisting of a computer software data base system used to input, store, retrieve, analyze, and display in map like form, spatially referenced geographical information for more detailed analysis of fields. Data Integration Through a Geographical Information System Use of Computer Hardware and Software to analyze the data collected by yield monitor and GPS and supply it to user in usable format – such as maps, graphs, charts or reports. Application of Precision irrigation through water management in precision agriculture. Identification of zones in the field that are irrigated with differing amounts and frequencies in precision irrigation.
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		amounts and frequencies in precision irrigation. (04 hrs)	
35	Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	182. Identify Cable and its Pin Mapping. (04 hrs) 183. Crimp and Test RJ9 / RJ11 / RJ45 connectors. (04 hrs) 184. Understand Frequency Band, Gain, Antenna and Modulation for WiFi. (04 hrs) 185. Understand Frequency Band, Gain, Antenna and Modulation for GPRS. (04 hrs) 186. Understand Frequency Band, Gain, Antenna and Modulation for RF. (04 hrs) 187. Design and Test Local Area Networks over Ethernet & Wi-Fi. (03 hrs) 188. Design and Test Cellular Wide Area Networks over GSM & GPRS. (02 hrs) 189. Design and Test Personal Area Networks over RF. (05 hrs)	Basic blocks of networking, - Specifications, Standards and types of cables, - Concept of wired or wireless communication medium - Different types of networks - Design and establish networks
36-37	Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit.	190. Identify, test and check series, parallel and series-parallel combination of Solar PV Modules. (12 hrs) 191. Measure VI Characteristics of Solar PV Module. (06 hrs) 192. Identify and test blocking diode and its working in Solar PV Module. (05 hrs) 193. Observe bypass diode and its working in Solar PV Module. (06 hrs) 194. Measure effect of inclination angle of Solar PV Module. (06 hrs) 195. Identify and test different charging techniques. (05 hrs) 196. Test Buck & Boost converter. (06 hrs) 197. Check effect of change in solar radiation on Solar PV Module. (04 hrs) 198. Identify and test running different applications i.e. LEDs, Dusk to Dawn sensing. (05 hrs)	Basics of solar Electricity, Working principle of PV panel, advantages of solar electricity and components of solar electricity, Various combinations, VI characteristics of solar PV module, effect of inclination angle on PV module, different battery charging techniques.

		199. Check the use of P V Analyzer. (05 hrs)	
38-39	Perform installation, configuration and Check working of IoT devices, network, database, app and web services.	200. Install Linux Operating System porting. (05 hrs) 201. Configure Local cloud & server. (05 hrs) 202. Configure Over the air (OTA) node. (05 hrs) 203. Parameter configuration using GUI. (05 hrs) 204. Check IoT Gateway using WiFi and Ethernet. (05 hrs) 205. Work with the command line and the Shell. (05 hrs) 206. Manage directories and files. Manage user access and data security (Cyber security) by Cryptography. (03 hrs) 207. Set up a Linux file system. Perform system initialization. (05 hrs) 208. Install and Configure Linux. (05 hrs) 209. Create Shell Scripts, flow control in the Shell, Advanced Shell features. (04 hrs) 210. Apply Database management system. (03 hrs) 211. Configure Cloud and Server for IoT. (04 hrs) 212. Test Qt based GUI. (02 hrs) 213. Test Web and Application Development Tools for IoT. (03 hrs)	Installation of Linux Operating System porting. Configuration of Local cloud & server. Over the air (OTA) node configuration. GUI based parameter configuration, GUI based IoT application. IoT Gateway using WiFi and Ethernet. User access and data security management (Cyber security) by Cryptography. The command line and the Shell, directories and files. Linux file system, understanding system initialization. Connection of a system to the network. Installation and Configuration of Linux. Shell Scripts, flow control in the Shell, Advanced Shell features. Database management system. Cloud and Server Configuration for IoT. Qt based GUI, IoT Web and Application Development Tools for IoT.
40-42	Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring.	214. Power up the Solar Inverter (similar device) as per the device manual. (03 hrs) 215. Integrate Solar Inverter (similar device) with serial protocol working on Modbus RTU. (04 hrs) 216. Communicate and Verify the parameters on Modbus Master Software (05 hrs) 217. Power up the DLMS device as per the device manual. (03 hrs) 218. Integrate device with serial protocol working DLMS	- Basics of Industrial protocols Modbus RTU, Modbus TCP, DLMS - Client server communication Basics of Protocol Converters. Basics of IoT Data Acquisition System. Device connectivity over cloud and troubleshooting. GUI based IoT Cloud Configuration utility. IoT device and its parameter

		protocol. (04 hrs) 219. Communicate and Verify the parameters on DLMS server software. (05 hrs) 220. Setup wired Local Area Network and wireless network. (04 hrs) 221. Setup environment for Modbus TCP/IP server client testing. (04 hrs) 222. Communicate and Configure Modbus devices through GSM GPRS network (04 hrs) 223. Setup Serial to Ethernet protocol converter and verify. (05 hrs) 224. Setup Serial to WiFi protocol converter and verify. (04 hrs) 225. Setup Serial to GPRS protocol converter and verify. (04 hrs) 226. Setup Ethernet IoT Data Acquisition system, connect to cloud and verify (05 hrs) 227. Setup WiFi IoT Data Acquisition system, connect to cloud and verify. (06 hrs) 228. Setup Cellular (GSM / GPRS) IoT Data Acquisition system, connect to cloud and verify. (04 hrs) 229. Explore IoT Cloud Configuration utility. (03 hrs) 230. Create / modify organization, Connect devices over cloud. (06 hrs) 231. Configuration of parameters, alarms, notifications on cloud platform. (04 hrs) 232. Explore user management roles and security. (04 hrs) 233. Observer Device Diagnostics for troubleshooting. (04 hrs) 234. Setup Environment for embedded SCADA testing. (05 hrs)	configuration Cloud Device Management and troubleshooting.
43	Demonstrate and deploy responsive Web Application	235. Explore Web API, required input parameters and output (04 hrs)	Usage of Web Services / Web API Development of Sample Web Application.

	using APIs and generate reports using templates.	236. Map Web API to Widget / Control / Plugin (10 hrs) 237. Display and configure graphs, charts and other ready to use controls and widgets (07 hrs) 238. To generate reports using readily available API, templates and to export it to excel, word pdf and other required formats (09 hrs)	Generation and export of Reports User access and rights management.
44	Identify and install the devices used in green house.	239. Select and Install Carbon dioxide sensors. (05 hrs) 240. Install Oxygen sensors. (05 hrs) 241. Carry out Selection and Installation of Volatile organic compound sensor. (05 hrs) 242. Execute Selection and Installation of Air temperature, Air humidity and atmospheric pressure sensor. (05 hrs) 243. Select and Install Soil Moisture and Soil Temperature sensor. (05 hrs) 244. Carry out Installation of Solar pump, motors and drip irrigation systems. (05 hrs)	Principle of selection and installation of Carbon dioxide sensor, Oxygen sensors & Volatile organic compound sensor. Selection and Installation of Air temperature, Air humidity and atmospheric pressure sensor. Selection and Installation of Soil Moisture and Soil Temperature sensor. Installation of Solar pump, motors and drip irrigation systems.
45-46	Monitor soil moisture, temperature etc. for controlling irrigation & record data.	245. Carry out Crop and soil observations logged in the form of snapped pictures, pinpoint locations, soil colours, water, plant leaves, and light properties. (05 hrs) 246. Measure leaf health, lighting brightness, chlorophyll amount, ripeness level, Leaf Area Index (LAI), soil organic and carbon makeup by using Smartphone Camera. (05 hrs) 247. Use Smartphone GPS for location for crop mapping, disease/pest location alerts, solar radiation predictions, and fertilizing. (05 hrs) 248. Perform predictive maintenance of machinery using Microphone. (05 hrs) 249. Determine Leaf Angle Index using Accelerometer. (05 hrs)	Process of carrying out Crop and soil observations logged in the form of snapped pictures, pinpoint locations, soil colours, water, plant leaves, and light properties. Measurement of leaf health, lighting brightness, chlorophyll amount, ripeness level, Leaf Area Index (LAI), soil organic and carbon makeup by using Smartphone Camera. Usage of Smartphone GPS for location for crop mapping, disease/pest location alerts, solar radiation predictions, and fertilizing. Predictive maintenance of machinery using Microphone Determination of Leaf Angle Index using Accelerometer. Application of Precision irrigation through water management in

		250. Apply Precision irrigation through water management in precision agriculture. (05 hrs) 251. Identify zones in the field that are irrigated with differing amounts and frequencies in precision irrigation. (05 hrs) 252. Apply Variable Rate Technology - Implement gathered information and decisions for site specific agriculture consisting of the machines and systems for applying a desired rate of crop production materials at a specific time and a specific location. (10 hrs) 253. Apply various Precision Agriculture tools: Soil Mapping, Yield Mapping, Remote Sensing, GIS Analysis, Nutrient Management, Variable Rate Technology, Integrated Pest & Weed Management, Water Management etc. for controlling irrigation & record data. (10 hrs) 254. Identify various benefits of application of Precision Agriculture in Smart Farming: Optimising Production Efficiency, Optimising Quality, Minimising Environmental Impact, Minimising Risk, Information To Act On. (05 hrs)	precision agriculture. Identification of zones in the field that are irrigated with differing amounts and frequencies in precision irrigation. Application of Variable Rate Technology - Implement gathered information and decisions for site specific agriculture consisting of the machines and systems for applying a desired rate of crop production materials at a specific time and a specific location. Application of various Precision Agriculture tools: Soil Mapping, Yield Mapping, Remote Sensing, GIS Analysis, Nutrient Management, Variable Rate Technology, Integrated Pest & Weed Management, Water Management etc. for controlling irrigation & record data. Identification of various benefits of application of Precision Agriculture in Smart Farming: Optimising Production Efficiency, Optimising Quality, Minimising Environmental Impact, Minimising Risk, Information To Act On.
47	Select plant health monitoring system and apply proper water, fertilizer and pesticides.	255. Test Non-contact surface temperature measurement. (02 hrs) 256. Test Leaf and flower bud temperature. (02 hrs) 257. Check Soil oxygen level. (02 hrs) 258. Test Solar radiation (shortwave, PAR and UV). (02 hrs) 259. Measure Air temperature, humidity and pressure. (02 hrs) 260. Observe Conductivity, water	Non-contact surface temperature measurement. Test of Leaf and flower bud temperature. Checking of Soil oxygen level. Test of Solar radiation (shortwave, PAR and UV). Measurement of Air temperature, humidity and pressure. Observation of Conductivity, water content and soil temperature. Test of Soil temperature and volumetric water content.

		content and soil temperature. (03 hrs) 261. Test Soil temperature and volumetric water content. (03 hrs) 262. Measure Soil water potentials. (03 hrs) 263. Test Vapor pressure, humidity, temperature, and atmospheric pressure in soil and air. (03 hrs) 264. Check Leaf wetness. (02 hrs) 265. Measure Stem, truck and fruit diameter. (02 hrs) 266. Test Wind speed and precipitations. (02 hrs) 267. Check Luminosity (Luxes Accuracy). (02 hrs)	Measurement of Soil water potentials. Test of Vapor pressure, humidity, temperature, and atmospheric pressure in soil and air. Checking of Leaf wetness. Measurement of Stem, truck and fruit diameter. Exploration and test of Wind and precipitations. Checking of Luminosity (Luxes Accuracy).
48	Identify and install the appropriate device for livestock monitoring.	268. Apply Wireless IoT in livestock monitoring - collect data regarding the location, well-being and health of cattle. (06 hrs) 269. Use Location Sensors, GPS & GPS integrated circuits. (06 hrs) 270. Apply Wearable Electronics to cattle. (06 hrs) 271. Use wireless retrofitted bolus in cow's stomach which can communicate via Bluetooth to an ear tag. (06 hrs) 272. Select wireless technology with enough battery power to list the lifespan of the animal. (06 hrs)	Application of Wireless IoT in livestock monitoring – collection of data regarding the location, well-being and health of cattle. Usage of Location Sensors, GPS & GPS integrated circuits. Application of Wearable Electronics to cattle. Usage of wireless retrofitted bolus in cow's stomach which can communicate via Bluetooth to an ear tag. Selection of wireless technology with enough battery power to list the lifespan of the animal.
49	Identify, select and operate drone in various applications.	273. Identify different types of drones – ground based and aerial based drones & their functions. (10 hrs) 274. Select various components of drones equipped with appropriate cameras, sensors (Optical Sensors etc.) and integrating modules (Raspberry Pi 3 B module - Single-board computer with wireless LAN and Bluetooth connectivity). (20 hrs)	Identification of different types of drones – ground based and aerial based drones & their functions. Selection of various components of drones equipped with appropriate cameras, sensors (Optical Sensors etc.) and integrating modules (Raspberry Pi 3 B module - Single-board computer with wireless LAN and Bluetooth connectivity).

50	Collect data using Drones.	275. Use ground-based and aerial based drones in agriculture for crop health assessment, irrigation, crop monitoring, crop spraying, planting and soil & field analysis. (04hrs) 276. Identify and apply thermal camera in smart farming. (02 hrs) 277. Carry out real-time data collection and processing, crop health imaging, integrated GIS mapping gathering valuable data via a series of sensors that are used for imaging, mapping, and surveying of agricultural land through drones/UAV. (04 hrs) 278. Select what field to survey altitude or ground resolution on the basis of farmer's information. (05 hrs) 279. Perform in-flight monitoring and observations. (05 hrs) 280. Collect multispectral, thermal and visual imagery during the flight of drones/UAV. (04 hrs) 281. Analyse Drone data for insights regarding plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, mapping, scouting reports, stockpile measurement, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping and so on. (06 hrs)	Usage of ground-based and aerial based drones in agriculture for crop health assessment, irrigation, crop monitoring, crop spraying, planting and soil & field analysis. Explore the use of thermal camera in smart farming. Process of Carrying out real-time data collection and processing, crop health imaging, integrated GIS mapping gathering valuable data via a series of sensors that are used for imaging, mapping, and surveying of agricultural land through drones/UAV. Selection of what field to survey altitude or ground resolution on the basis of farmer's information. Principle of in-flight monitoring and observations. Collection of multispectral, thermal and visual imagery during the flight of drones/UAV. Analysis of Drone data for insights regarding plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, mapping, scouting reports, stockpile measurement, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping and so on.
50	Project Work/Industrial Visit (Optional) Broad Area:- - Measurement of different soil moisture & temperature - Measurement of solar radiation/oxygen for green house - Construct wireless communication link between different nodes. - Industrial visit for the applications of DRONE		
51	Revision		
52	Examination		

Note: -

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3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*



Skill India
कौशल भारत - कुशल भारत

9. SYLLABUS – CORE SKILLS

CORE SKILL – EMPLOYABILITY SKILL		
First Semester		
1. English Literacy		Duration : 20 hrs Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.	
Reading	Reading and understanding simple sentences about self, work and environment	
Writing	Construction of simple sentences Writing simple English	
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happening, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers, ordinal numbers. Taking messages, passing on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
2. IT Literacy		Duration : 20 hrs Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of the computer.	
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc. Use of Common applications.	
Word Processing and Worksheet	Basic operating of Word Processing, Creating, Opening and Closing Documents, Use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & Creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.	

Computer Networking and Internet	Basic of Computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, WebSite, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self awareness Importance of commitment Ethics and values Ways to motivate oneself Personal goal setting and employability planning.
Facing Interviews	Manners, etiquettes, dress code for an interview Do's & don'ts for an interview
Behavioral Skills	Problem solving Confidence building Attitude
Second Semester	
4. Entrepreneurship Skills	
Duration : 15 hrs Marks : 06	

Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & record, Role & function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing Analysis	Qualities of a good entrepreneur, SWOT and risk analysis. Concept & Application of PLC, Sales & Distribution management. Difference between small scale & large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's Support	Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies /programmes, procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop act, Estimation & costing, Investment procedure - Loan procurement - Banking processes.
5. Productivity	
Duration : 10 hrs Marks : 05	
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in select industries, e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and insurance.
6. Occupational Safety, Health and Environment Education	
Duration : 15 hrs Marks : 06	
Safety & Health	Introduction to occupational safety and health Importance of safety and health at workplace.
Occupational Hazards	Basic hazards, chemical hazards, vibro acoustic hazards, mechanical hazards, electrical hazards, thermal hazards. Occupational health, occupational hygiene, occupational diseases/ disorders & its prevention.
Accident & Safety	Basic principles for protective equipment.

	Accident prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & sick at the workplaces, First-aid & transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to environment. Relationship between society and environment, ecosystem and factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of energy, re-use and recycle.
Global Warming	Global warming, climate change and ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.
7. Labour Welfare Legislation	
Duration : 05 hrs Marks : 03	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.
8. Quality Tools	
Duration : 10 hrs Marks : 05	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of housekeeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.

List of Tools & Equipment			
IoT TECHNICIAN (SMART AGRICULTURE)			
S No.	Name of the Tools and Equipment	Specification	Quantity
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit sl. 1-12 is required additionally)			
1.	Connecting screwdriver	10 X 100 mm	10 Nos.
2.	Neon tester 500 V.	500 V	6 Nos.
3.	Screw driver set	Set of 7	10 Nos.
4.	Insulated combination pliers	150 mm	6 Nos.
5.	Insulated side cutting pliers	150mm	8 Nos.
6.	Long nose pliers	150mm	6 Nos.
7.	Soldering iron	25 Watt, 240 Volt	10 Nos.
8.	Electrician knife	100 mm	6 Nos.
9.	Tweezers	150 mm	10 Nos.
10.	Digital Multimeter	(3 3/4 digit) ,4000 Counts	10 Nos.
11.	Soldering Iron Changeable bits	15 Watt, 240 Volt	6 Nos.
12.	De- soldering pump electrical heated, manual operators	230 V, 40 W	10 Nos.
B. SHOP TOOLS, INSTRUMENTS – For 2 (1+1) units no additional items are required			
Lists of Tools:			
13.	Steel rule graduated both in Metric and English Unit	300 mm,	4 Nos.
14.	Precision set of screw drivers	T5, T6, T7	2 Nos.
15.	Tweezers – Bend tip		2 Nos.
16.	Steel measuring tape	3 meter	4 Nos.
17.	Tools makers vice	100mm (clamp)	1 No.
18.	Tools maker vice	50mm (clamp)	1 No.
19.	Crimping tool (pliers)	7 in 1	2 Nos.
20.	Magneto spanner set	8 Spanners	2 Nos.
21.	File flat bastard	200 mm	2 Nos.
22.	File flat second cut	200 mm	2 Nos.
23.	File flat smooth	200 mm	2Nos.
24.	Plier - Flat Nose	150 mm	4 Nos.
25.	Round Nose pliers	100 mm	4 Nos.
26.	Scriber straight	150 mm	2 Nos.
27.	Hammer ball pen	500 grams	1 No.
28.	Allen key set (Hexagonal -set of 9)	1 - 12 mm, set of 24 Keys	1 No.

29.	Tubular box spanner	Set - 6 - 32 mm	1 set.
30.	Magnifying lenses	75 mm	2 Nos.
31.	Continuity tester	With 4 ½ Digit Display and 20k Count	6 Nos.
32.	Hacksaw frame adjustable	300 mm	2 Nos.
33.	Chisel - Cold - Flat	10 mm X 150 mm	1 No.
34.	Scissors	200mm	1 No.
35.	Handsaw 450mm	Hand Saw - 450 mm	1 No.
36.	Hand Drill Machine Electric with Hammer Action	13 mm	2 Nos.
37.	First aid kit		1 No.
38.	Bench Vice	Bench Vice - 125 mm	1 No. each
		Bench Vice - 100 mm	
		Bench Vice - 50 mm	
List of Equipments			
39.	Multiple Output DC regulated power supply	0-30V, 2 Amps, $\pm 15V$ Dual Tracking ,5V/5A, Display digital, Load & Line Regulation: $\pm (0.05 \% + 100 \text{ mV})$, Ripple & Noise: 1 mVrms. Constant Voltage & Current operation	4 Nos.
40.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A with numeric keypad, PC interface and LCD for Voltage, Current & Power	2 Nos.
41.	LCR meter (Digital) Handheld	It can Measure six basic parameters R,C,L equipped with SMD Component Test Fixture	1 No.
42.	70 MHz Mixed Signal Oscilloscope (4 Analog + 16 Digital Channel)	With more than 20Mpt memory Real time Sampling 1GSa/sec , having LAN Interface with, I2C , SPI, Runt etc .. And RS232/UART, I2C and SPI trigger decoding functions , two channel 25MHz awg plus math functions like differentiation, integration, abs, AND,OR,NOT etc..an	1 No.

43.	25 MHz Arbitrary Waveform Generator with Digital Display for Frequency and Amplitude	Two Channel , 200MSa/Sec and 2Mpt memory with more than 150 different arbitrary waveforms and built-in 8 th order harmonic generation and 150MHz Frequency counter PC Connectivity USB Device/Host and LAN	1 No
44.	6 1/2 Digit Digital Multimeter	Measurement Functions: DC & AC Voltage, DC&AC Current, 2-wire & 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor. Temperature: RTD, THERM, TC (B/E/J/K/N/R/S/T) PC Interface USB Host, USB Device, LAN(LXI-C) Measurement Speed 10k readings/sec	1 No.
45.	3GHz Spectrum Analyzer with built-in Tracking Generator	Frequency Range 9 kHz to 3.2 GHz Resolution Bandwidth(-3 dB): 10 Hz to 1 MHz Built in tracking generator Min. -148 dBm DANL Display 8" TFT or more PC Interface: USB Host & Device, LAN(LXI)	1 No
OR Electronics Workbench		Item no. 39, 41, 42, 43, 44 and 45 can be preferred in the form of workbench.	1 No.
46.	Multi Function Test & Measuring Tool for Field Applications and Testing compatible with Laptop	300 MHz Bandwidth 2 Channel Digital Storage Oscilloscopes, Spectrum Analyzer. Arbitrary Waveform Generator Sine 50MHz , Square 15MHz, Triangle 100KHz , AM –FM Modulation,	1 No.

		16 Channel Logic Analyzer Frequency and Phase Meter USB 2.0/ 3.0 Interface	
47.	Electrical Safety Trainer	Demonstration of importance of earthing in any electrical device. Arrangement to study role of fuse and types of slow blow, high blow fuse in any electronic circuit. Arrangement to study the importance of MCB and it's working.	1 No.
48.	Analog Component Trainer with following Seven Basic Modules • Diode Characteristics (Si,Zener,LED) • Rectifier Circuits • Diode as Clipper Circuit • Diode as Clamping Circuit • Zener as voltage regulator. • Transistor Type NPN & PNP and CE Characteristics • Transistor as a switch	Breadboard for Circuit design DC power supply: +5V,1A (Fixed); +12V, 500mA (Fixed); ±12V, 500mA (Variable) AC power Supply: 9V-0V-9V, 500mA Function Generator: Sine, Square, Triangle (1Hz to 100KHz) Modulating Signal Generator: Sine, Square, Triangle (1Hz to 10KHz). Voltage, current and frequency on board LCD display. PC Interface – Acquisition from two analog input channel Simulation Software	1 No.
49.	Digital IC Trainer	Breadboard: Regular DC Supply: +5 V/1 A +12V/1A Clock Frequency 4 different steps from 1Hz – 100KHz Amplitude: (TTL), 128x64 Graphical LCD, Pulser Switches, Data Switches: 8 Nos, LED: 8 Nos. (TTL),Seven Segment Display, Teaching &	1 No

		Learning Simulation Software	
50.	IT Workbench for computer hardware and networking	The bench comprises with Computer Hardware Training System (02 Nos.) The different circuit boards of PC/AT Computer are exposed on a PCB, LAN Training System with Wireless LAN as well to study Peer to Peer, STAR, RING Topology. Protocols: CSMA /CD, CSMA /CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring, Colored representation of data in transmission & reception. Data transmission speed: 10/100 Mbps, Smart managed 3 Layer and 2 Layer Switch, Media converter, POE Switch, Wi-Fi LAN card, IP Camera, Energy meter, LED tube light, Voltmeter and Ammeter will be fitted. Networking Fundamentals Teaching Simulation Software DSO 50MHz 4 Channel , 1GSa/Sec ,more than 20 Mpt memory DSO DMM : 4^{1/2} Digit with LCD Display	1 No.
51.	Laptop latest configuration		1 No.
52.	Laser jet Printer		1 No.
53.	Internet Broadband Connection		1 No.
54.	Electronic circuit simulation software with five user licenses	Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D	1 No.

		View of PCB, Breadboard View, Fault Creation and Simulation.	
55.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
56.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
57.	SMD Soldering & De soldering Station with necessary accessories	SMD Soldering & Desoldering Station Digitally Calibrated Temperature Control SMD Soldering & Desoldering Power Consumption : 60 Watts I/P Voltage : 170 to 270 V De-soldering : 70 Watt Temperature Range : 180 to 480° Centigrade Power Consumption : 270 Watts Hot Air Temperature : 200 to 550° Centigrade	1 No.
58.	SMD Technology Kit	SMD component identification board with SMD components Resistors, Capacitors, Inductors, Diodes, Transistors & IC's packages. Proto boards with readymade solder pads for various SMD Components. SMD Soldering Jig.	1 No.
59.	Microcontroller kits (8051) along with programming software (Assembly level Programming) With six important different application modules	Core 8051 MCU clocked at 11.0592 MHz., supporting both programming modes Keypad and computer ,LCD for both programming and run mode, ready to run programmer to support	1 No.

	1. Input Interface Switch, Matrix Keypad, ASCII Keypad 2. Display LCD, Seven Segment, LED Matrix 3. ADC & DAC 4. PC Interface module 5. Motor DC, Stepper, Servo 6. DAQ	family of controllers AT89C52 ,DC Power Supplies +12V, -12V, +5V & -5V, Breadboard to make circuits, Learning content through simulation Software and following application modules 1. Input Interface : 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC with ADC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: 4ch analog 10bit, 22 DIO resolution, 6MHz Frequency Counter (square wave), DAQ with PC interface software	
60.	Sensor Trainer Kit Containing following Sensors a) Air humidity and Temperature b) RTD c) Atmospheric Pressure d) Air Quality e) Smoke Detector Sensors f) Limit Switch g) Photo sensors h) Capacitive displacement	IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor & DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output. Ethernet port to connect real world. Inverting, Non – Inverting, Power, Current, Instrumentation and Differential Amplifier, F to V, V to F, I to V, V to I Converter, High Pass and Low Pass Filter, Buffer, LED, Buzzer, LED Bar Graph, Touch Switch Included Sensors :RTD,NTC Thermistor,LM35,Photovoltaic, Air humidity and Temperature, Gas(Smoke), Air Quality, Atmospheric Pressure, Limit switch, Capacitive displacement	2 Nos.
61.	Different types of electronic and electrical cables, connectors,		As required

	sockets, terminations.		
62.	Different Microcontroller/Processor Training and Development Platform for AVR, PIC, ARM and Arduino.	MCU PIC16F877A , 4MHz, Onboard programmer will program PIC Devices, USB Port MCU ATMEGA8515 ,8MHz, onboard programmer will program ATMEGA series microcontroller, USB Port MCU LPC2148 , 12MHz,LED 8Nos, ADC 10 bit 10Nos, DAC 10bit ,USB and RS232, RTOS support, JTAG Connector, USB2.0,Onboard Zigbee, I2C,SPI,RTC,DC motor, PWM, Sensor LM35 , Display 16X2 LCD Display , Motor Drive: L293D 600mA (5-12V),Programmer USB Interface. Microcontroller ATmega328p (Arduino Based), 16MHz, Digital I/O Pins : 14 (of which 6 provide PWM output) , Flash Memory : 16KB (of which 2KB used by boot loader) Each platform should have Bread DC Power Supplies +12V, -12V, +5V & - 5V, Breadboard to make circuits.	1 No.
63.	Internet of Things Explorer	Processor : 64bit ARMv7 with 1GB RAM , Memory 32GB ,OS: Open source Linux, Connectivity: Wireless LAN,	1 No.

		Bluetooth, Zigbee, USB & Ethernet, HDMI interface, 1.77" Color TFT LCD , Driver for Stepper and DC Motor, six 16 bit Analog Input, RTC and 4-20mA input. Zigbee: 2.4GHz, Sensors: Temperature and Humidity, Air Quality, Soil Moisture, Ambient Light, Soil/Water temperature, PIR Sensor. GSM IoT Gateway - Quad-Band 850/900/1800/1900 MHz - GPRS multi-slot class, Control via AT commands. Explore physical and application layer protocols like RS232, RS485, GSM, Ethernet and MQTT, CoAP, HTTP, FTP. Cloud/server configuration includes HTML, Java, php and mySQL. IoT Node: Wireless 2.4GHz Zigbee, 5 Analog Inputs and at least 3 Digital Outputs, At least one I2C Channel, support OTA. Online Cloud/Server Services for 2 years. Battery 3.7V/4400mAH with Solar Panel, USB interface.	
64.	Field Interface and Protocol Simulation Kit	A console including :Any Branded Desktop Computer with Windows Operating System - Ethernet Devices with Isolated Supply and port 4 AI(0.1% FSR), 4 AO (0-10VDC), Ethernet Port – Qty 1 8 Relay Outputs, Ethernet Port – Qty 1 8 Pulse Outputs, Ethernet Port – Qty 1 8 Digital Inputs, Ethernet	1 No.

		Port – Qty 1 4 RS485 Slave ports, 1 Ethernet Port – Qty 4 2. 16 Port Ethernet Switch for networking of field ethernet devices 3. SMPS to power up multiple ethernet based field simulation devices 4. Required Connectors, Switches and LED indicators for Field Interface circuits such as Digital Inputs, Relay Outputs, Analog Inputs, Analog Outputs, Pulse Signals 5. Software - Communication with simulation device on ethernet MODBUS TCP Protocol - Field Interface simulation using HMI replica of Console for easy understanding of students - Port Simulation – Serial Port Terminal, TCP/IP, UDP, HTTP - Protocol Simulation – MODBUS RTU Master/Slave, MODBUS TCP Master/Slave, DLMS Client IoT Protocol Simulations – MQTT topic publish subscribe simulation	
LIST OF THE MACHINERIES FOR SEMESTER II			
65.	Solar Power Lab	Solar PV Modules. Open Circuit Voltage Voc 10V,	1 No.

		Short Circuit Current I_{sc} .60m A Maximum Power Voltage (V_{mp}) 8.80V, Maximum Power Current (I_{mp}): 0.57A, Batteries , Voltage 6V, 4Ah. Buck & Boost Converter, Dusk to Dawn Sensing, LCD for Voltage and Current. Interactive Solar Training Software	
66.	Solar PV Module Analyzer	Micro-controller Based with 16X2 LCD, PC Interface, mains & battery operated. Capable to measure Open Circuit Voltage and Short Circuit Current, Maximum Voltage and Current at Maximum Power DCV Range 0-50V, DCA Range 10A	1 No.
67.	Wireless Communication modules for interfacing with microcontrollers a) RFID Card Reader b) Finger Print c) Zigbee d) GPS e) GSM f) Bluetooth g) WiFi	Core 8051 MCU clocked at 11.0592 MHz, supporting both programming modes Key Pad and PC ,LCD for both programming mode and run mode, ready to run programmer to support family of controllers AT89C51/52 & 55 ,DC Power Supplies +12V, -12V, +5V & -5V,Breadboard to make circuits, detailed learning content through simulation Software and following application modules : RFID Card Reader ,Finger Print, Zigbee, GPS, GSM, Bluetooth and WiFi	1 No.
68.	Sensors for Green House Application	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: CO ₂ : Range: (0-2000ppm), O ₂ Range: (0-25%), VOC, Air Temperature& humidity, Atmospheric Pressure, Soil Moisture& Temperature, NO ₂ , Leaf Wetness, Solar Radiation,	1 No.

		UV Index.	
69.	Solar Water Pump	1HPSolar Panel 40W (36Nos) MPPT 400 TO 700V DC Operating Frequency : 30Hz to 50Hz, Protection : Dry Run , Short Circuit Maximum PV Voltage 750V DC Remote Operation through GSM module	1 No.
70.	Weather Monitoring System	Temperature Range : -10°C to 90°C, Relative Humidity Operating Range 0 to 95% , Wind Speed Sensor Speed : 0 to 20m/S Resolution 1m/S , Wind Direction, Rainfall Bucket collector, Solar Radiation, UV Index, Atmospheric Pressure, Air Quality, PM2.5, GSM based cloud connectivity, Application Software for Dashboard for remote monitoring and analysis. Power Supply Battery : 12V/42AH Solar Panel : 100W	1 No.
71.	Sensors & Actuator for Irrigation Application	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: Capacitive Soil Moisture & Temperature, Leaf Wetness, Solar Radiation(0-2000mw/m2), Thermal Imager Actuators :Sprinklers, Relay, Flow sensor	1 No.
72.	Sensors for Livestock Monitoring	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: Active & Passive RFID tags with reader, Bluetooth tags with application software, GPS and PIR.	1 No.
73.	DRONE (optional)	Including the Flight Controller, and a RF Sensing System that provides reliability during flight. Also It should have spraying system and flow sensor ensures accurate operations. Intelligent Operation Planning System and should have	1 No.

		Agriculture Management Platform, User can plan operations, manage flights in real-time, and closely monitor aircraft operating status Spray System : Tank Volume minimum 8L Payload Approx 8 Kg	
74.	IoT based Smart Roof Top / Solar Pump system (Application Project)	1. Inverter (can be existing inverter of Solar Kit) 2. IoT based Energy Monitoring DCU with Three Phase 415 VAC input, Two RS485 MODBUS Communication Port, Local Ethernet connectivity, Four Analog Inputs (24-bit ADC, 0.1%FSR) for integration of weather sensors, SD Card Storage, Remote GSM/GPRS connectivity using Quad Band GSM/GPRS Module 3. Embedded Calculations for %CUF (capacity utilization factor), %PR (Performance Ratio) 4. SMC box with IP65 and IK10 ratings Responsive Web application for Smart Energy management system having with map view based dash board and individual system details with various energy management reports such as load profile, consumption pattern, generation pattern, %CUF (capacity utilization factor), %PR (Performance Ratio) etc.	1 No.
75.	IoT Data Acquisition Systems &	Connectivity to Cloud (IBM,	1 No.

	Protocol Converters	Microsoft, Amazon)24 VDC Isolated Supply, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs Ethernet IOT DAQ, WiFi IoT DAQ, Cellular (GSM / GPRS) IoT DAQ MODBUS RTU to MODBUS TCP 24 VDC Isolated Power Supply, 4 Isolated MODBUS RTU Master Port Serial to Ethernet, Serial to Wi-Fi, Serial to GPRS	
76.	IoT EDGE Computing Device	Embedded SCADA for 500 Tags, 24 VDC Isolated Power Supply, 4 MODBUS RTU Master, 32 GB Built in SD Card, 1 Wi-Fi Port, 1 Ethernet Port, 1 GPRS Port, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs	1 No.
77.	Cloud Based IoT SCADA	1000 Tag License for Cloud based SCADA to connect IoT Devices and IoT based Smart Systems with Device Manager, IO Server, Alarm Server, Historian and Reporter, Web Server. Cloud Hosting Services for 20 devices for 7 years	1 No.
C. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
78.	Instructor's table		1 No.
79.	Instructor's chair		2 Nos.
80.	Metal Rack	100cm x 150cm x 45cm	4 Nos.
81.	Lockers with 16 drawers standard size		2 Nos.
82.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
83.	Interactive Smart Board with		1 No.

	Projector		
84.	Fire Extinguisher		2 Nos.
85.	Fire Buckets		2 Nos.



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TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS		
S No.	Name of the Equipment	Quantity
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2	UPS - 500Va	10 Nos.
3	Scanner cum Printer	1 No.
4	Computer Tables	10 Nos.
5	Computer Chairs	20 Nos.
6	LCD Projector	1 No.
7	White Board 1200mm x 900mm	1 No.
Note: Above Tools & Equipments not required, if Computer LAB is available in the institute.		



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FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:						Year of Enrollment:								
Name & Address of ITI (Govt./Pvt.):						Date of Assessment:								
Name & Address of the Industry:						Assessment location: Industry/ ITI								
Trade Name:			Semester:			Duration of the Trade/course:								
Learning Outcome:														
S No.	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15	Total Internal Assessment Marks	Result (Y/N)
	Candidate Name	Father's/Mother's Name	Safety Consciousness	Workplace Hygiene	Attendance/ Punctuality	Ability to Follow Manuals/ Written Instructions	Application of Knowledge	Skills to Handle Tools & Equipment	Economical Use of Materials	Speed in Doing Work	Quality in Workmanship	VIVA		
1														
2														